form, is not taught, disclosed or made obvious by the combination of Palazzolo, et al., Alkhimov, et al. and Shepard. Specifically, Alkhimov, et al. discloses a gas dynamic spraying method which utilizes a spray gun that in most situations is unacceptable for utilization in Applicants' environment. More specifically, the spray gun of Alkhimov is too large to place within a cylinder of an automotive internal combustion engine, the main environment of Applicants' invention. This inability of Alkhimov's method provoked Applicants to their invention that is described in the present application as a spray gun which could be utilized to spray a cylinder bore in an internal combustion engine. The claims related to Applicants' inventive spray gun were canceled due to a restriction requirement and are the subject of Applicants' divisional application, now pending. Therefore, one knowledgeable in the art of Palazzolo, et al. would not think to use the Alkhimov spray gun due to its inability to spray inside a cylinder.

The above incompatibility of using the Alkhimov spray gun to spray a cylinder bore is further buttressed by a reading of Alkhimov, column 10, lines 16-21. As shown in Figure 1, the length of the supersonic portion of the nozzle has to be at least 25-100 times the width of the nozzle shown in Figure 3, along lines b. Accordingly, one familiar with Palazzolo would not think to use Alkhimov to practice Applicants' inventive method. The addition of Shepard to the combination of Palazzolo and Alkhimov would not be made since Shepard is primarily teaching methods of liquid metal spraying, methods that Applicants are trying to get away from.

Additionally, Shepard would lead Applicants away from their invention. Shepard, in column 6, lines 63-67, teaches rotating the cylinder about its center during the application of the lining material molybdenum. This teaching is contrary to Applicants' invention for the following two reasons: one, rotating the cylinder would be disadvantageous on an internal combustion engine since each cylinder would have to be lined individually. Two, more importantly, Applicants' deliberately lined the cylinders in up and down relative movement so that there is no formation of horizontal fissures or cracks in the layer material. Horizontal fissures and cracks in such a lining could create places where lubricant oil could collect away from the lining surface. Therefore, the up and down relative movement between the nozzle and the engine block inhibits any horizontal cracks in the lining.

In relation to claim 3, it should be noted that Shepard teaches a first lining material of molybdenum, which is significantly harder than stainless steel, and accordingly would lead

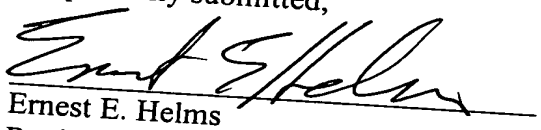
one knowledgeable with the above-cited reference in a manner away from Applicants' invention as defined by claim 3.

In regard to claim 20, none of the above references, either taken singularly or in combination, teach a method wherein the cylinder is initially coated with a first material and then the cylinder is coated with a blend transient gradient of first and second materials, and then coating the bore with a second material as provided in Applicants' inventive method.

Furthermore, nowhere do the above-noted references teach or describe a method wherein the first material is sized between 10 and 45 microns and the first material is sized less than 5 microns.

Applicants have shown that the Examiner's rejections are respectfully traversed. As the application is otherwise in condition for allowance, such action is respectfully requested.

Respectfully submitted,



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Dated: August 7, 2002

CERTIFICATE OF MAILING (CFR 1.8)

I hereby certify that the this AMENDMENT and proposed redlined drawing are being deposited with the United States Postal Service as postage prepaid first-class mail in an envelope addressed to Assistant Commissioner For Patents, Washington, D.C. 20231, on this 7th day of August, 2002.

Donna Crumit

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE TITLE

The title has been changed as follows: -- GAS-DYNAMIC COLD SPRAY LINING METHOD FOR ALUMINUM ENGINE BLOCK CYLINDERS

IN THE SPECIFICATION

On page 2, the paragraph starting at line 8 and ending at line 22 has been changed as follows:

To function properly, the inserted liners must have a full integral surface-to-surface bond that promotes thermal transfer as if the liner and cylinder bore were one unitary piece. However, some of the best material from a wear standpoint for lining the cylinder have the poor heat transfer characteristics or, in other words, have a high heat transfer resistance and therefore cannot be used. Also, the hoop stress that exists in the aluminum engine block, which is a result of an interference fit liner, can lead to high residual stresses in the engine block. To compensate for the residual stress within the engine block, the dimensioning of the engine block and the liner may be enlarged. The enlargement of the liner or ~~he~~ the engine block adds to the weight of the engine block and works against the desired goal of increased fuel economy.

On page 13, the paragraph starting at line 5 and ending at line 15 has been changed as follows:

Depending upon factors such as the flow velocity, the diameter of the constriction, gas viscosity and mass density, particle size, and the initial radial position of the solid particle, different degrees of focusing will occur. This subcritical velocity focusing can be further improved by using multiple constrictions in series to progressively move the particles closer to the central axis. Thus, with the aerodynamically focused powder stream and with the supersonic nozzle held at an angle, with respect to a ~~perpendicular~~ line parallel to the local surface, of about 30°, maximum impact and control can be obtained.

IN THE CLAIMS

Claims 1, 6 and 7 are amended as follows:

1. (Amended) A method of lining a cylinder bore of a reciprocating piston internal combustion engine aluminum engine block comprising:

spraying said cylinder bore with a gas-dynamic cold spray to coat said cylinder bore with a lining material differing from a material of said engine block, said spray coming from a nozzle having up and down relative movement with said engine block, and said nozzle being at an angle at 30° plus or minus 15° with a surface of said cylinder bore.

6. (Amended) A method as described in claim ~~5~~ 1, wherein said nozzle is translated up and down through said cylinder bore.

7. (Amended) A method as described in claim ~~6~~ 1, wherein said nozzle is positioned along a longitudinal center axis of said cylinder bore.

Please add new claims 20-23:

20. (New) A method as described in claim 1 further including initially coating said cylinder bore with a first material, and then coating said bore with a blend of transient gradient of first material and a second material, and then coating said bore with a second material.

21. (New) A method as described in claim 20 wherein said first material has a lower thermal resistance and wear resistance than said second material.

22. (New) A method as described in claim 1 wherein said first material is sized between 10-45 microns and said second material is sized less than 5 microns.

23. (New) A method as described in claim 20 wherein said first material is sized between 10-45 microns and said second material is sized less than 5 microns.

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